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(54) Disposable Diaper

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## SPECIFICATION

### 1. TITLE OF THE INVENTION DISPOSABLE DIAPER

### 2. SCOPE OF THE UTILITY MODEL CLAIMS

#### [Claim 1]

A disposable diaper, having an absorbent member enclosed between a moisture impermeable outer layer and a moisture permeable inner layer, comprising a moisture detecting part wherein a water soluble coloring agent layer is formed on the inner surface of the moisture impermeable outer layer, and a water insoluble coating agent layer is laminated over the aforementioned coloring agent layer.

#### [Claim 2]

The disposable diaper according to utility model claim 1, wherein the water soluble coloring agent layer is formed from a water based coloring agent where a dye and/or pigment is dissolved and/or dispersed in a water based binder.

#### [Claim 3]

The disposable diaper according to utility model claim 1, wherein the water insoluble coating agent layer is formed from a colored or colorless coating material with an oil based binder as a main component.

[Claim 4]

The disposable diaper according to utility model claim 3, wherein the water insoluble coating material contains an additive in the composition for hardening the water based binder resin in the coloring agent.

### 3. DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a disposable diaper with a moisture detecting part, and in particular, relates to a disposable diaper wherein the color changes in a pattern or text such as a printing pattern provided on the diaper beforehand, and thereby the wetness of the diaper can easily be detected.

Conventionally, checking a diaper for wetness and soiling has been extremely inconvenient for caregivers of infants and the elderly who wear diapers, and being able to detect these conditions from outside the diaper easily is desired. Many proposals have previously been made to satisfy this desire, such as a method where the diaper will electrically generate light or sound due to wetness, a method where the diaper generates a fragrance, and a method where color is generated or changed by a special indicator chemical due to the effect of water or urine or the like. However, the aforementioned methods fail to take into consideration the psychological aspects of infants and the elderly, or are lacking with regard to safety, hygiene, or detection certainty, and the like.

Furthermore, there have also been proposals that relate to a type of indicator chemical in which a colorant runs and becomes non-visible by contact with moisture, but in this case, detection certainty is lacking because the coloring agent, which is the indicator chemical, disappears.

As a result of diligent research to resolve the aforementioned problems with conventional detection methods, the present inventors have achieved the present invention by discovering inexpensive means for simple and certain detection that can be applied to disposable diapers, and particularly to those that have recently become widely used.

A representative example of a disposable diaper that has been widely used in the past is the diaper with the construction shown in FIG. 1 and FIG. 2.

The disposable diaper shown in FIG. 1 and FIG. 2 has a moisture impermeable outer layer 12 and a moisture permeable inner layer 11 with an absorbent member 14 enclosed therein. Furthermore, if using on an infant or the like, the diaper is used by fastening it to the body using adhesive tape 13 or the like.

Furthermore, the moisture impermeable outer layer 12 is made from a soft semi-transparent polyethylene film or the like, and the moisture permeable inner layer 11 is made from a thin sheet material such as a soft nonwoven material.

Furthermore, the absorbent member 14 enclosed in the aforementioned two layers is primarily made of a moisture absorbent fibrous material such as crushed pulp, and if necessary can also contain special materials such as water absorbent polymer materials and the like. Note, the absorbent member 14 is enclosed in normal thin paper or a web sheet 15 or the like.

The present invention provides a disposable diaper having an absorbent member enclosed between a moisture impermeable outer layer and a moisture permeable inner layer as shown in FIG. 1 and FIG. 2, containing a moisture detecting part wherein a water soluble coloring agent layer is formed on the inner surface of the

moisture impermeable outer layer, and a water insoluble coating agent layer is laminated over the aforementioned water soluble coloring agent layer.

FIG. 3 shows a specific example of the construction of a disposable diaper with a moisture detecting part, wherein (a) is a partial cross-section view and (b) is a drawing showing a part of the inner surface of the moisture impermeable outer layer.

The present invention has a moisture detecting part 2, which is a laminate body made by first forming a water soluble coloring agent layer 21 that will wash off with wetness on the inner surface of the moisture impermeable outer layer 12, and then forming a colored or colorless coating agent layer 22 with water resistance, formed by lamination on the coloring agent layer. By laminating with materials with different water resistances, if the laminate body becomes wet with water, the pattern such as an image or text formed by the water soluble coloring agent layer will wash off, and only the area laminated with the coating agent layer with water resistance will not wash off and will remain. By using these properties, an image or text or the like will appear or will change appearance such that the wetness can be detected.

Herein, the coloring agent layer and the coating agent layer can be formed by normal application means such as flexographic printing, gravure printing, and screen printing, or lamination can be performed using a roll coater or spray method or the like.

The water soluble coloring agent layer is formed by applying a water based coloring agent containing a colorant in a water based binder, which is a main component thereof.

Furthermore, the water insoluble coating agent layer can be obtained by lamination using a colored or colorless oil-based coating material that contains an oil soluble or solvent based binder as a main component.

Note, the water based binder can be a water soluble binder made from a resin such as an acrylic resin, a styrene-acrylic resin, an ethylene-acrylic resin, a styrene-maleic acid resin, a maleic acid resin, a rosin-maleic acid resin, polyvinyl alcohol, polyvinyl acetal, casein, zein, carboxymethyl cellulose, and shellac and the like. These resins can be used individually or 2 or more types can be blended together and used, depending on the objective of use. Furthermore, an aqueous dispersion of a water-based binder resin such as an acrylic resin, styrene-acrylic resin, styrene-shellac resin, vinyl acetate resin, vinyl chloride-vinyl acetate resin, or polyester resin can also be used.

Furthermore, the colorant that is used in the coloring agent can be a water soluble dye or pigment (including white pigments), or the like. Note, the alkali that is used to make the water soluble binder water soluble is preferably an alkali that has low volatility such as sodium hydroxide, triethanolamine and the like.

On the other hand, the water insoluble coating can primarily contain a binder where cellulose nitrate, polyamide, rubber chloride, ethylene-vinyl acetate copolymer, polypropylene chloride, acrylic, urethane, shellac, and rosin, and the like that are used in oil based paints or printing inks are dissolved in various types of organic solvents and the like. Furthermore, additives with a function that harden the binder resin in the water-soluble coloring agent can also be added to the coating agent. Examples of these additives include aluminum, zirconium, titanium, and other metal chelating compounds, as well as aziridine compounds, isocyanate compounds, epoxy compounds, and the like.

Note, various other additives such as colorants, fillers, and water repelling

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agents can also be added in order to provide application and printing suitability.

The present invention is described below in greater detail using concrete examples, but the present invention is not restricted to these examples.

#### Coloring Agent Manufacturing Example 1

A 5% aqueous solution of polyvinyl alcohol (Gosenol GH-13, manufactured by Nippon Synthetic Chemical Industry Co., Ltd.) was prepared, and then 1 weight% of food coloring red #3 (manufactured by Kiriya Chemical Co., Ltd.) and 9 weight% of ethanol were added to 90 weight% of the aqueous solution to produce coloring agent 1.

#### Coloring Agent Manufacturing Example 2

Coloring agent 2 was manufactured by adding 1 weight% of food coloring blue #1, 40 weight% of ethanol, and 19 weight% of water to 40 weight% of a 25% nonvolatile fraction aqueous solution of acrylic resin (Joncryl-142, manufactured by Johnson Corporation) that was neutralized with sodium hydroxide.

#### Coating Agent Manufacturing Example 1

Coating agent 1 was manufactured by adding 15 weight% of cellulose nitrate (manufactured by Asahi Kasei Corp.) and 10 weight% of polyamide resin (Polymide S40EA, manufactured by Sanyo Chemical Co. Ltd.) in 75 weight% of a solvent blend containing toluene, isopropanol, and ethyl acetate.

#### Coating Agent Manufacturing Example 2

Coating agent 2 was manufactured by dissolving 15 weight% of the nonvolatile fraction of urethane resin (Sanprene, manufactured by Sanyo Chemical Co. Ltd.) and 5 weight% of cellulose nitrate (manufactured by Asahi Kasei Corp.) in 79 weight% of a solvent blend containing toluene, isopropanol, and methylethyl ketone, and then adding 1 weight% of a titanium chelating compound (Titabond 50, manufactured by Nippon Soda Co., Ltd.).

#### Embodiments 1 through 4

Disposable diapers with a moisture detecting part were manufactured by laminating and applying coloring agents 1 and 2 and coating agents 1 and 2 by gravure printing in the combinations shown in the following table onto the inner layer of the white polyethylene film that is used as the water insoluble outer layer of the disposable diaper in order to form the moisture detecting part. Approximately 100 mL of water was added from the moisture permeable inner layer side of the disposable diaper with a moisture detecting part, the printing pattern of the coloring agent layer was washed off, and then the condition of only the remaining portion that was laminated with the coating agent layer was observed. Then, the rate of change from the pattern of the coloring agent layer to the pattern of the coating agent layer, and the stability of the water resistance of the coloring agent/coating agent laminated portion were evaluated.

	Embodiment			
	1	2	3	4
Coloring Agent Name	1		2	
Coating Agent Name	1	2	1	2
Change in Printing Pattern	O	O	O	O
Stability of Laminated Body When Wet	O	(O)	O	(O)

From the foregoing results, it was determined that the moisture detecting part of the present invention was a detecting part that was sensitive to wetness, and if an additive that hardens the binder resin in the coloring agent layer is added to the coating agent layer, the water durability stability of the portion laminated with the coloring agent layer and the coating agent layer will be improved.

FIG. 4 is a drawing showing an example that is convenient for detection by forming the coloring agent layer and the coating agent layer with various images and text. FIG. 4(a) shows an example where a stripe pattern is formed by the coloring agent layer, and the part of this stripe that forms the text "WET" is covered by a laminate with a colorless coating agent. Prior to wetting, a stripe pattern (A) is shown, but after wetting, the text "WET" (B) appears.

FIG. 4 (b) shows a similar example that has a square pattern (A) prior to wetting that becomes a round pattern (B) after wetting.

Note, the moisture detecting part can be formed on the entire surface or locally on any part of the inner surface of the water impermeable outer layer of the disposable diaper.

#### 4. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 and FIG. 2 are drawings showing the construction of a representative disposable diaper, and FIG. 1 is a perspective view of the appearance, while FIG. 2 is a cross-section view showing the internal construction.

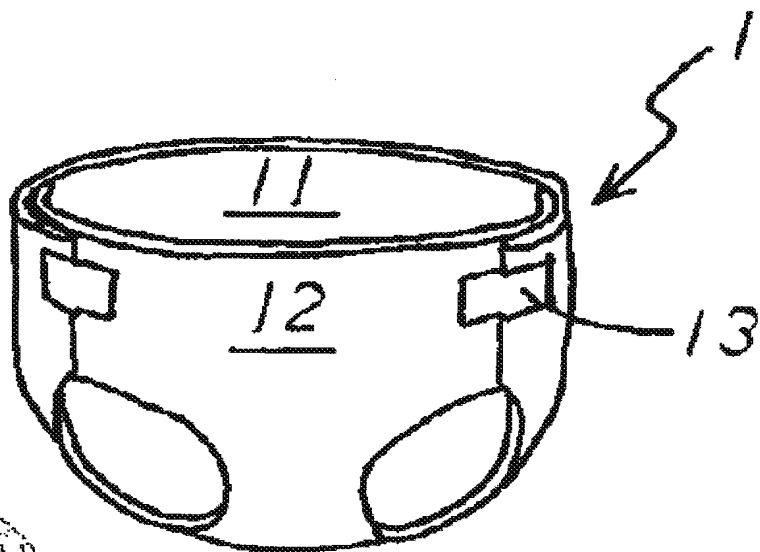
FIG. 3 shows a concrete example of the construction of a disposable diaper according to the present embodiment, where (a) is a partial cross section view, and (b) is a drawing showing a part of the inner surface on the moisture impermeable outer layer.

FIG. 4 is a drawing showing an example that makes detection convenient by forming the coloring agent layer and the coating agent layer with various images and text.

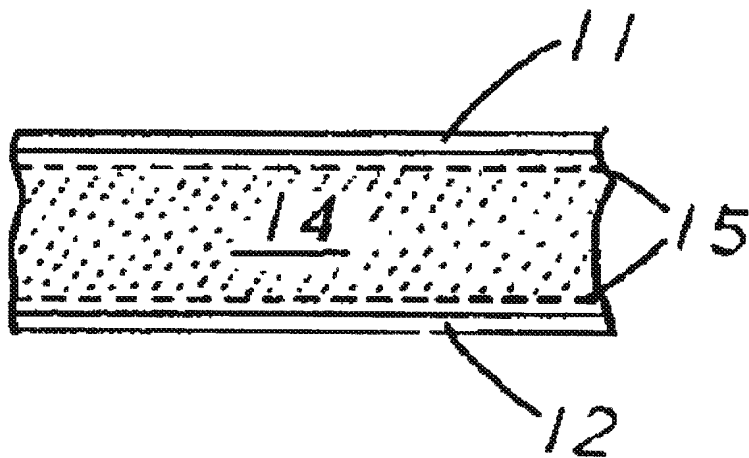
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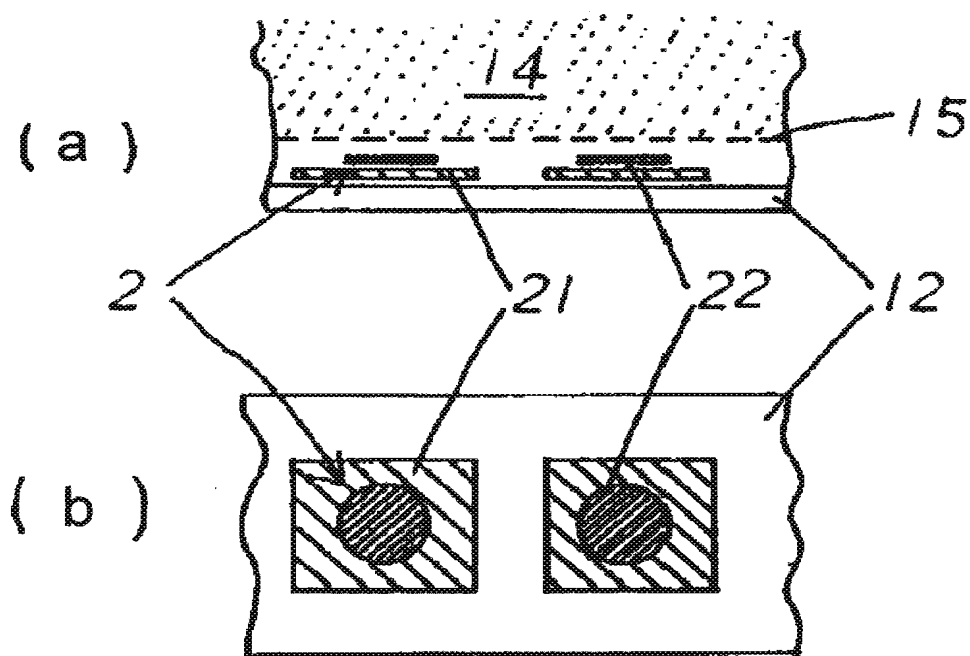
[FIG. 1]



[FIG. 2]



[FIG. 3]



[FIG. 4]

